Bank Lending Rate Pass-Through and Differences in the Transmission of a Single EMU Monetary Policy

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Abstract

The pass-through from the money market rate to several bank lending rates and the government bond rate is investigated for 12 European countries over the period 1980-2000, by applying a SVAR based on the Cholesky decomposition. Simulations of a one percent point rise in the money market rate, performed for all countries, reveal divergences within and between countries in the dynamics of the lending rate pass-through. Subsequently, this pass-through is introduced in an enlarged SVAR model to account for the intermediation role of banks in the transmission process of monetary policy to the real economy, for 7 European countries. The simulation results indicate a significant role for the banking sector. Moreover some asymmetries in the price of credit both within and across countries in Europe exist. The different effects on the real economy (private consumption and investment) depend on the magnitude of the lending rate pass-through.

Keywords: Transmission of monetary policy, EMU, Bank intermediation, Lending rates, Pass-through, SVAR, Impulse response analysis.

JEL Classification: E43, E44, E52, G21.

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Contents

1 Introduction

The transmission of monetary policy has been at the centre of discussions among economists and monetary authorities during the last decades. In particular, the relinquishment by the European Monetary Union (EMU) countries of their monetary policy prerogatives has brought the issue of the impact of a single European monetary policy on its members. A flourishing literature developed to investigate potential asymmetric effects and the transmission mechanisms at work in the Euro-zone. Although heuristically, the structural differences between countries are fully acknowledged and documented, there is no conclusive empirical evidence of those asymmetries yet. Against this background, the financial structure and the financial intermediaries have benefited from a great interest among the researchers. This paper focuses on the banks' intermediation role in the transmission of monetary policy in Europe.

Particularly, the contribution of this paper consists in the estimation of the bank lending rate pass-through, i.e. the transmission of changes in the money market to the lending rates. The measurement of the pass-through is performed by means of a structural vector autoregressive (SVAR) system. Consecutively, this pass-through is included in a general macro-model (enlarged SVAR including output and inflation) to disentangle the impact of monetary policy on the real economies in Europe and the role of the banks in this process. The scope is to assess whether the transmission of monetary policy hinges on the intermediation role of the banking sector, i.e. via the setting of their lending rates. In this respect, this paper differs from the existing studies on the pass-through[1].

This paper also attempts to reconcile two approaches to the issue. The first approach consists of the "macroeconometric type" of studies, including variants of vector autoregressive models (VAR). These studies estimate macro-models in order to simulate the effect of monetary policies on the real economy by means of impulse response analysis or variance decomposition. Recently, there have been some attempts to account for the cross-country differences in the financial structure and in its major intermediaries, the banks[2]. Typically, bank balance sheet data or other financial structure proxies are included in the VAR systems. The second approach concentrates on the interest rate pass-through from a policy rate to market rates, more precisely the bank lending rates. This strand of literature tries to assess the impact of monetary policy on banks. The pass-through provides the magnitude and timing of the transmission of a monetary innovation to the lending rates. However, to our knowledge, this pass-through is never included into a larger macroeconometric framework (VAR analysis), although the bank retail rates are crucial to the efficient transmission of monetary policy in Europe. "*It is these rates that provide the final link in the mechanism for the transmission of monetary impulses that arise from changes in official interest rates*"[3]. Therefore the addition of those bank lending rates to a VAR system is relevant to consider the differential effects of the pass-through on the real economy across countries.

[1] Cottarelli and Kourelis (1994), Borio and Firtz (1995) and Mojon (2000).

[2] Banks finance the burden of firm and private investments in Europe. See Morsink and Bayoumi (2000), De Bondt (1999), Garretsen and Swank (1998), and Bank for International Settlements (1995).

[3] Note on the Euro area retail interest rates, ECB, 2001, p1.

The remainder of this paper is outlined as follows. The next section presents an overview of the existing literature, going briefly through the theoretical fundamentals and the empirical studies on the role of banks in Europe and in the USA, the pass-through approach and finally the vast "VAR" literature about the transmission mechanisms of monetary policy. The third section develops the methodology and presents the data. This section is subdivided into two parts corresponding to the two steps of this study. First, it concentrates on the pass-through analysis, the data and the estimation method used for this purpose; then, following the same structure, it turns to the estimation of the effects of the pass-through on the real economy. The fourth section discusses in more detail the results of the first part of this study: the simulations of the pass-through for a rise of 1% point in de money market during one year on the bank lending rates. This pass-through is estimated for 10 EMU countries, Greece and the United Kingdom over the period 1980-2000 and over the sub-period 1992-2000. Several lending rates are involved: long-term rate for households, long-term rate for firms and short-term rate for firms. To anticipate the results, evidence of divergences both within and between countries is found. Subsequently (section 5), the pass-through is included in an enlarged SVAR framework such that the interactions between the real economy and the bank intermediation can be evaluated. The coverage for this second step of the analysis is reduced to 7 countries over the period 1980-1998. To preview the results, the simulations performed tend to support the existence of an intermediation role for banks in the transmission of monetary policy. Furthermore, European countries still demonstrate divergences within and between countries in the dynamics of the lending rate pass-through; hence the different effects on the real economies observed for the countries considered. Section 6 summarizes our findings.

2 Related literature

2.1 The intermediation role of banks

The theoretical roots of the intermediation role of banks lie in the imperfections of the financial markets: there is no perfect substitute for bank loans (neither the money, nor the bonds). Several seminal papers stress the special nature of bank loans and, therefore, advocate that credit market imperfections play an important role in the monetary policy transmission (Bernanke and Blinder (1988-1992), Gertler and Gilchrist (1993)). It is also accepted that credit market imperfections (and their consequences: moral hazard and adverse selection) may induce credit rationing (Stiglitz and Weiss (1981)). As a result of these existing imperfections special banking relationships or particular banking structures may have some buffer or loan rate smoothing effect (Berger and Udell (1992), Berlin and Mester (1998)). As far as the empirical work is concerned, the Bank for International Settlements (BIS(1995)) conducts a very detailed study on the relation between financial structure and transmission mechanisms. It combines descriptive and statistical evidence on the structural features and pioneers the study of the asymmetries between countries by providing the first signs of divergences.

Traditionally, the empirical literature on the role of banks in the transmission mechanisms of monetary policy (also called bank lending channel as part of the credit view) has focused on

volume data, i.e. balance sheet data. Numerous papers concentrate on the differences within countries by focusing on the asymmetries between types of lenders (large or small banks) and types of borrowers (households or firms) (Gertler and Gilchrist (1994), Oliner and Rudebush (1996), Kashyap and Stein (1995-1997-2000)). Other authors consider both the differences within countries and between countries of the European Union but do not reach any conclusive evidence on the issue (Kashyap and Stein (1997), Cechetti (1999), De Bondt (1999), Favero, Giavazzi and Flabbi (1999)). This is mainly due to the poor quality of the European banking data[4]. Yet, the unavailability of valuable volume banking data (individual or nationally aggregated) has driven research in another direction: price data, i.e. bank lending rates.

2.2 The speed of adjustment of bank credit rates

Based on bank lending rates estimated in an error correction model (ECM), Cottarelli and Kourelis (1994) provide a measure of the different degrees of lending rate stickiness for 31 countries (including 8 from Europe). They also relate the degree of stickiness to structural features of the financial system. Hence, they offer some evidence of the relevance of credit markets for the monetary transmission. They suggest that the lending rates do not fully adjust for a monetary change (no full pass-through). As far as the cross-country differences are concerned, they seem to be particularly strong in the short run (3 months after impact). Belgium, Finland and Italy[5] show the slowest pass-through after a monetary change, while the Netherlands and the UK show a pass-through of more than 50%. Germany and Spain fluctuate around 30%. The authors explain those differences by structural differences such as the existence of barriers to competition, the development of the financial markets, and the ownership structure of the banking system[6].

Borio and Fritz (1995) conduct a similar study (included in BIS (1995)). Twelve countries are considered, among which six are European, over the period 1984-1994. The country classification -Spain, Italy, France and Belgium versus United Kingdom and the Netherlands- is no clear-cut compared to the study previously mentioned, especially in the case of Belgium. The estimation over a sub-period (1990-1994) casts some doubts on the statistical significance of the differences between European countries.

More recently, Mojon (2000) shows that there are country asymmetries in Europe but that they should diminish over time as the integration increases (single monetary policy, money market integration, development of debt securities markets, etc). He bases his estimations on the data set of the European Central Bank (ECB), pooling market interest rates (lending and deposit ones) for Belgium, France, Germany, Italy, the Netherlands and Spain over the period 1980-1998[7]. He estimates a model including an error correction term (ECT) to account for the

[4] See Degryse, Donnay and Heremans (2000) for a review of this strand of literature and a discussion of the conclusions.

[5] Cottarelli, Ferri and Generale (1995) focus on the Italian banking system and perform the estimation on a micro data set of 63 local banks (1986-1993). They confirm the higher degree of stickiness in Italy and underline the particular features of the banking sector (degree of concentration, securitization, etc.).

[6] More details can be found in the fourth section of their paper. In ongoing research, we investigate more deeply the driving factors of the pass-through.

[7] Mojon estimates for both the lending and the deposit rates. The deposit rates are not reported here. He

cointegration between the lending rates and the money market rate. Over the whole period, the averages[8] of the pass-through 3 months after the monetary shock are 0.35 for Belgium, 0.61 for Germany, 0.15 for Spain, 0.83 for France, 0.67 for Italy and 0.77 for The Netherlands. Over the sub-period 1992-1998, the pass-through averages converge to respectively, 0.55, 0.54, 0.22, 0.42, 0.58, and 0.86. The pass-through is negatively influenced by the volatility of the money market rates, but positively by the competition from other sources of financing and the increasing competition in the banking sector; which explains the reduction in the country asymmetries. Therefore, a further deregulation of the banking sector in Europe, more alternative financing sources as well as a smoother evolution of the money market (harmonized monetary policy) can accelerate the pass-through[9].

2.3 The transmission of monetary policy in European countries

The second approach adopted in this paper is embodied in the vast "VAR" literature[10]. The vector autoregressive analysis has been a very popular tool in empirical macroeconomics and finance. For our concern, it is possible to distinguish two branches in this field. First, the studies that concentrate exclusively on the question whether monetary policy shocks, among others, may induce differential effects or asymmetries in the real economy in Europe. Second, the research that tries to specifically integrate the financial structure and the bank intermediation in the general macro-model. This strand of the literature does not only ask the question regarding the asymmetric effects, but it also deals with the issue of which transmission channels are at work and to what extent the financial structural features affect the transmission of a monetary innovation. Basically, the first family of papers limits its specification to the three standard variables: output, price and interest rates/monetary instrument (and sometimes exchange rate); while the second one adds some balance sheet data or other proxies for the financial structure.

Gerlach and Smets (1995), Barran, Coudert and Mojon (1996), Britton and Whitley (1997), Dornbusch, Favero and Giavazzi (1998), Christiano, Eichenbaum and Evans (1998), Ramaswamy and Sloek (1998), Kieler and Saarenheimo (1998) are some of the most widely known representatives of the first family. Both Britton and Whitley (1997) and Kieler and Saarenheimo (1998) provide a comprehensive overview of the literature classified by categories, types of specification (structural VAR, single equation model, etc.). Siegfried (1999) summarizes nicely the four studies that apply the SVAR methodology for Europe. Overall, it seems difficult to draw some definitive conclusions. The studies mentioned here are carried out under different assumptions and with different methods which makes them difficult to compare. Kieler and Saarenheimo draw the following conclusions: *"Although it may be perfectly reasonable to have more faith in*

also performs several tests on the interest rate cycle asymmetry and a detailed investigation of the determinants of the pass-through.

[8] See his Table 2b. Averages over all the rates used (including long-term, short-term, firms or households). For more details and a breakdown of the results for the individual rates, please refer to Table 2a of Mojon (2000).

[9] According to Centeno and Mello (1999) and to Kleimeier and Sander (2000), the European banking markets (along with the financial markets as a whole) are still segmented and this poses a challenge for the European authorities.

[10] We include under this denomination all categories of macro models : MEM1s, MEM2s, SSMs, SEMs and SVAR, see classification in Britton and Whitley (1997).

the results of one study or method over the others, the variation in the results indicates that econometric analysis has not provided consistent evidence about either the extent or the ranking of possible differences in monetary transmission across EU countries." (Kieler and Saarenheimo (1998), p.12.)

The second family of studies focuses specifically on the distinction between the possible transmission channels. Especially the bank lending channel that attributes an important role to banks is often introduced within the VAR framework. Again, there is no choice but to admit that there is no consensus about the importance of the bank lending channel. This is especially the case for Europe in view of the poor quality of the data available.

Tsatsaronis (1995) is one of the first who explicitly carries out such a research. He applies a single equation, and a SVAR methodology, associated with the narrative approach, to four countries: Germany, Japan, UK, USA. The variables included are: output, money and bank loans. He concludes that there is a clear buffer effect in Germany (no fall in the credit after a contractionary monetary policy, which means no distinct credit channel accentuating the traditional money channel). In contrast, Japan seems to experience a fall in credit and so a bank lending channel[11], although this result is sensitive to the estimation period. Roughly speaking, the UK may be classified with the countries where credit may play a role, while the USA remains with a strong money channel although these results are sample sensitive too.

By using sectoral data, some authors highlight the distributional impact of the bank lending channel and identify asymmetries between borrowers (firms versus households), types of credit (long-term versus short-term) and size of the banks (big versus small) (Kueppers (1999) for Germany). The money channel and the credit channel would be more relevant for the firms and the personal sector, respectively (Dale and Haldane (1995) for UK).

Leaving the sectoral analysis, Coudert and Mojon (1995)[12] perform a cross-country comparison and establish the following results: a rise in the interest rate triggers a fall in the credit in Italy and France, no change in the UK and an increase in Germany. Hence no bank lending channel for the United Kingdom and Germany.

In contrast to all studies reported here, Garretsen and Swank (1998) build a SVAR with an error correction term (vector error correction model (VECM) with 5 cointegrating relationships). They simulate (by using impulse response analysis) the effect of a change in the German interest rate on the Dutch economy with a special attention paid to the banking sector. They find a buffer effect that reduces the effectiveness of monetary policy, hence the traditional money view appears more relevant in the Netherlands, unlike the credit view (bank lending channel). As far as the Netherlands is concerned, De Bondt (1999) draws the same conclusions. He considers several balance sheet data items for 6 European countries : Belgium, Germany, France, Italy, the Netherlands and the UK. His VECM specification includes only one cointegration equation. He finds a significant bank lending channel for Germany, France and Italy.

[11] This is confirmed by Morsink and Bayoumi (2000).
[12] Confirmed in Barran, Coudert and Mojon (1996).

3 Methodology and data

The goal of this paper is to investigate the dynamics of some macroeconomic fundamentals (output, inflation, money market rate, bond rate and bank lending rates) after a monetary policy shock. The VAR technique (and its numerous variants) allows for the computation of impulse response functions that provide the evolution path of all variables after an unexpected exogenous shock in any of the variables included in the model. By extension of the impulse response analysis, the VAR is often used to simulate the impact of diverse monetary policies. This statistical method is, therefore, frequently used in the research field of macro-monetary economics.

For our purpose, there are three different ways to specify the VAR model: a structural vector autoregressive model (SVAR) in levels, a SVAR in first differences and a vector error correction model (VECM). The choice of any one of them remains a debatable issue[13].

Unlike the standard VAR, the SVAR model includes a decomposition method for the orthogonalization of the shocks (variance-covariance matrix of the error terms) required for the impulse response analysis. In this way, it reduces the symmetric dimension of the VAR by imposing a structural behaviour on the variables[14]. The Cholesky decomposition method (recursiveness assumption) is one of the most popular decomposition technique. This consists in imposing restrictions on the contemporaneous relationships between the variables to solve the so called identification problem. A second variant is the SVAR in first differences that corrects for the non-stationarity of the variables but not for the cointegration (existence of long-term relationships between the non-stationary variables considered). The third and last possibility is the VECM that includes an error correction term (ECT) to control for the long-term relationship between the cointegrated variables. This is a constrained version of the SVAR. Although the VECM has not been applied regularly in the literature treated above, there are some applications of this methodology[15] in another but still related context: controllability, stability and predictability of money in Europe (Vlaar and Schuberth (1999), Hubrich and Vlaar (2000), and Coenen and Vega (1999)). Resorting to the VECM method is appealing because it establishes cointegration relationships between the variables usually considered in the transmission mechanisms literature : output, inflation, money, short-term and long-term interest rates. Those possible relations are: long-run demand for money, long-run Fisher equation or stationary real interest rate, and interest rate spread or term structure of the interest rate, etc. Those cointegrated relationships

[13] Lütkepohl (1993) and Hamilton (1994) provide a comprehensive and technical discussion of the various multiple time series analysis methods (among which VAR and SVAR).Verbeek (2000), and Enders (1995) supply a more intuitive approach, quite attractive to economists. This section is mainly based on Enders (1995) and Lütkepohl (1993).

[14] But it still offers more flexibility than a system of simultaneous equations that imposes a fixed structural behaviour among the variables and distinguishes exogenous from endogenous variables. Simultaneous equations also do not allow for the decomposition of the shocks.
In this sens a SVAR approach generalize the usual set of independent equations (including error correction term) applied in the existing pass-through literature because it allows for interaction between the variables while identifying the different shocks.

[15] Vlaar (1998) provides a good technical paper on the VECM method that he subsequently applies to German interest rates (short-term and long-term) in order to account for the term structure relation between the rates.

could easily be combined with an accepted finding of the pass-through literature, namely some long-term relation between the money market and the lending rates.

However, the use of the VECM is arguable. Lütkepohl (1993, chapter 11) proves that the SVAR in levels and the VECM are asymptotically equivalent. However, this proof is conditional upon the relevance and accuracy of the long-run restrictions imposed on the VECM. Hence, the SVAR and the VECM should provide the same impulse response functions unless wrong cointegration relationships are included that could bias the results and the dynamics provided by the VECM. Therefore, to avoid any misleading dynamic analysis, the SVAR method is applied in the remaining of the paper[16]. After all, the description of the short-run dynamics of the variables remains our main goal.

The next two sections briefly summarize the SVAR technique for a bivariate and a multivariate system. For notational simplicity only the bivariate case is discussed in detail. It is extended to the multivariate case afterwards. The bivariate SVAR is used to estimate the pass-through between the money market rate and the bank lending rates. The mutlivariate case extends the first one by adding macroeconomic fundamentals (output, inflation, consumption, investment, etc.). It is called upon to measure the impact of the pass-through on the real economy. Both systems rely on different data sets (in periodicity, coverage and number of countries included) that are, in each case, introduced in the beginning of the respective sections.

3.1 Bivariate case of the SVAR : The pass-through

3.1.1 The data

This paper first concentrates on the bank-lending rate pass-through in Europe. For this purpose, money market rates and several lending rates are used. As a benchmark we check the pass-through of monetary policy to government bonds. This study is conducted for 12 European countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain and the United Kingdom; although not all retail rates are available for every country.

The choice of the money market rates as policy instrument instead of the policy rate (discount rate) is motivated by the discontinuity and inaccuracy in the policy rate series[17]. Moreover, most of the time, the policy is conducted by means of a combination of instruments that would be poorly represented by the sole policy rate. Therefore, the money market rate seems to be the most appropriate measure of monetary policy since it is the most correlated with the central banks policies as a whole.

[16] In an earlier version of this paper, both the SVAR and the VECM specifications have been tested in order to compare them and check for the relevance of cointegrating equations. The scope was to provide some support for possible long-run equilibria between the variables considered and to account for them while estimating the short-term dynamic of the system. Knowing that the unconstrained SVAR gives the best representation of the reality, a comparison of its results with the VECM ones (constrained by the cointegration relationships) constitute a robustness test for the existence and the accuracy of the long-run relationships such as they are imposed on the VECM. Results are available upon request.

[17] Over the 20 years covered in this study, the instruments of monetary policy may have changed.

The money market rates and the bond rates are obtained from the IFS/IMF database[18]. The lending rates are extracted from the homogenized ECB database on the national retail rates. Three kinds of lending rates are included: a long term rate for household[19] (LTH), and both a short-term and a long-term rate for firms[20] (STF and LTF respectively). The set of monthly data ranges from 1980:M1 to 2000:M5[21]. Some countries have a smaller coverage (10 years, in the worst case 5 years[22]). In these cases, some caution is required in the interpretation of the results. A detailed presentation of the data is available in Appendix I.

All the series have been tested for non-stationarity. In a large majority of the cases, the tests for the presence of a unit root are contradictory[23]. The money market rates, bond rates and the lending rates have also been tested for cointegration. The results seem to indicate cointegration but they are not robust to the specification of the tests, hence not very reliable.

3.1.2 The model

The two variables considered are the money market rate, MM_t, and RR_t, the retail rates (either bank lending rate or bond rate) of the European countries.

The specification is basically two AR interrelated and estimated one after the other by OLS. The error terms are assumed to be white noise (serially uncorrelated), so $E(\varepsilon_t) = 0$, $E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon$ and $E(\varepsilon_t \varepsilon_{t+1}) = 0$. Although the Akaike and Schwarz criteria were quite stable between 4, 6 and 12 lags, the partial autocorrelation function was high until lag 4. Therefore the number of lags was limited to four which confirms the expectation that interest rates should adjust quite quickly.

$$MM_t = c^1 + \sum_{i=1}^{4} a_i^1 MM_{t-i} + \sum_{i=1}^{4} b_i^1 RR_{t-i} + \varepsilon_t^1 \tag{1}$$

$$RR_t = c^2 + \sum_{i=1}^{4} a_i^2 MM_{t-i} + \sum_{i=1}^{4} b_i^2 RR_{t-i} + \varepsilon_t^2 \tag{2}$$

Equations (1) and (2) are the two reduced forms of the primitive system. They can be

[18] IFS Code: money market rate, 60B; government bonds, 61.

[19] ECB Code: N2, mortgage loans to household.

[20] ECB Code: N4, short-term loans to enterprises; N5, medium and long-term loans to enterprises.

[21] Needless to say that this limited period is not optimal to assess a possible convergence in the EMU and the banking sector. The single monetary policy only exists for 5 months in the database considered. Therefore, drawing some conclusions for the current period and the future may be questionnable. However, some convergence in the money market rate was already observed for some countries over this period. Especially Austria, the Netherlands, Belgium and France present a high correlation for the money market rate with Germany (respectively, 0.96, 0.95, 0.84, 0.77). Italy and Greece have a correlation of 0.67 and 0.69. The other countries fluctuate around 0.6. These correlations significantly increased over the period 1992-2000 (except for Ireland and the UK). Austria, the Netherlands, Belgium, Finland and France are the most correlated (sometimes perfectly) while Greece and Italy reach values around 0.8.

[22] This is the case for Austria (LTH and STF), Finland (Bonds), Germany (LTH), Greece (Bonds), Italy (LTH and LTF) and the UK (LTH). For those rates we are left with only 40 to 60 monthly observations.

[23] The results of the augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests, which were quite contradictory, are available upon request.

rewritten in matrix notation to obtain the standard form of the SVAR[24].

$$\mathbf{Y}_t = \mathbf{c} + \sum_{i=1}^{4} \mathbf{A}_i \mathbf{Y}_{t-i} + \boldsymbol{\varepsilon}_t \tag{3}$$

Where Y_t is a (2x1) vector of variables, c is a (2x1) vector of intercepts, A_i is a (2x2) matrix of the coefficients,and ε_t is the error term vector (2x1) for the two variables:

$$\mathbf{Y}_t = \begin{bmatrix} MM_t \\ RR_t \end{bmatrix}$$

$$\mathbf{c} = \begin{bmatrix} c^1 \\ c^2 \end{bmatrix}$$

$$\mathbf{A}_i = \begin{bmatrix} a_i^1 & b_i^1 \\ a_i^2 & b_i^2 \end{bmatrix} \tag{4}$$

$$\boldsymbol{\varepsilon}_t = \begin{bmatrix} \varepsilon_t^1 \\ \varepsilon_t^2 \end{bmatrix}.$$

In order to compute the impulse response functions, the $AR(4)$ representation of the model must be reduced to an $AR(1)$ form and finally be transposed into a $MA(\infty)$ representation. Therefore, we can write the MA representation in a general form :

$$\mathbf{Y}_t = E_0(Y_t) + \sum_{i=0}^{\infty} \mathbf{\Phi}_i \boldsymbol{\varepsilon}_{t-i}. \tag{5}$$

Where Φ_i is a (2x2) matrix of lag polynomials of infinite order depending on the coefficients of A_i in the AR representation. The first term of expression (5) is the long-term value of the vector Y_t and will be dropped in the final expression of the impulse response functions since it is not relevant to study the dynamics of the variables.

The matrix Φ_i contains the impact multipliers that are used to compute the effects of shocks on the variables' path, i.e. the impulse response functions.

The last important step is the identification of the shocks in the system. The underidentification problem is solved by using a Cholesky decomposition on the observed shocks, ε_t, to recover the orthogonal structural shocks, η_t.

[24] The VECM version of this model includes an error correction term that represents the cointegrating equation (long-run relationship) between the money market rate and the bank lending rate or the bond rate. The long term equilibrium between the money market rate and the bank lending rate is realized for $RR_t \succ MM_t$. As far as the bond rate is concerned the cointegration relationship can be seen as the term structure of the interest rates. Results of the estimations using both SVAR and VECM techniques prove to be quite robust regardless of the method applied: the impulse response functions estimated by SVAR and VECM match perfectly. These similarities support the theoretical (and empirical) predictions that forecast a long-term equilibrium between the money market rate and both the bank lending rate and the bond rate; hence cointegration is verified.
In the end, the method does not seem to matter significantly.

$$\boldsymbol{\eta}_t = \mathbf{L}^{-1}\boldsymbol{\varepsilon}_t \tag{6}$$

With $\mathbf{L} = \begin{bmatrix} L_{11} & 0 \\ L_{21} & L_{22} \end{bmatrix}$,where L is a lower triangular matrix with standard deviations of the structural shocks on the diagonal such that $E(\varepsilon_t \varepsilon_t') = LL'$. The structural shocks are uncorrelated (orthogonal), $\boldsymbol{\eta}_t \backsim iid(0, I)$.

The Cholesky decomposition boils down to a recursiveness assumption: constraints are imposed on the simultaneous effects and within the period effects are ruled out. The intuition of this decomposition is that a shock on the last ordered variable in the ordering of the system does not contemporaneously affect the previous one(s). In other words, a shock in the retail rates will have no contemporaneous effect on the money market rates ($L_{12} = 0$) while the opposite is not true. Therefore, the ordering of the variables is a crucial element of this assumption.

The orthogonal impulse responses for a shock introduced in the $\boldsymbol{\eta}_{t-i}$ vector are obtained by combination of equation (5) and (6).

$$\mathbf{Y}_t = \sum_{i=0}^{\infty} \boldsymbol{\Theta}_i \boldsymbol{\eta}_{t-i} \tag{7}$$

where $\boldsymbol{\Theta}_i = \boldsymbol{\Phi}_i \mathbf{L}$.

3.2 Extension to the multivariate case : Impact of the pass-through on the real economy

3.2.1 The data

By including the pass-through, measured in the bivariate system, in an enlarged SVAR, it is possible to account for the effects of the pass-through on the real economy. In this way we attempt to assess the interactions between the banking sector and the economy regarding the investment decisions, the setting of the lending rates, etc.

Besides the interest rates, the multivariate model includes additional data on output, private consumption, investment and inflation. Those series are extracted from the IFS/IMF database[25]. Private demand is computed by substraction of the government spending from the GDP. Private demand is also divided into two components (consumption and investment) by substraction of the investment. The CPI is used as a measure of inflation. All series are seasonally adjusted[26] and rendered real by means of the CPI (base year is 1995). They are also taken in logs (except for the interest rates). Interest rates are taken in decimals.

Unfortunately, the availability of data constrains us to reduce the periodicity and the number of countries with respect to the bivariate case. Output, government spending and investment are only available on a quarterly basis. The period now ranges from 1980:Q1 to 1998:Q4. The countries included are: Belgium, France, Germany, Italy, the Netherlands, Portugal and Spain.

[25] IFS/IMF code: GDP, 99B; Government spending, 91; Investment, 93E; CPI, 64.

[26] The seasonally adjustment is performed by using the Eviews package (ratio to moving average).

3.2.2 The model

In this section, the few changes implied by the inclusion of additional variables are briefly discussed. By and large, the method and its successive steps remain unchanged[27]. The vector of variables $\mathbf{Y}_t$ becomes:

$$\mathbf{Y}_t = \begin{bmatrix} PD_t \\ CPI_t \\ MM_t \\ RR_t \end{bmatrix} \tag{8}$$

Where PD is the private demand, CPI is the inflation, MM is the money market rate (instrument of the shock) and RR is the retail rate. There exists many variants of this model that can be used as comparative references. First, the traditional system, that is used here as a benchmark, includes the three traditional variables (output, inflation and money market rate). Second, the distinction between the two components of private demand: consumption and investment. Finally, both the bond rates and the bank lending rates are used for the RR_t. The Cholesky decomposition is maintained even though, with quarterly data, the within the period effects can not be excluded. There is indeed a potential simultaneity problem due to this identification method. The ordering associated with the decomposition is: real economy variables, prices, monetary instrument, and retail rates. So it allows for contemporaneous effect of the money market rates on the other rates but not on the previously ordered variables.

Two lags are included as the partial autocorrelation function recommends it. Four, six and eight lags do not improve significantly the information criteria (Akaike and Schwarz), hence this choice of parsimony out of regard for the small number of observations. The results are discussed in section 5.

4 The interest rate pass-through in Europe

This section presents the results of the simulation exercises for the transmission of a monetary change to the lending rates in Europe. The system estimated contains exclusively interest rates and aims at investigating the reaction of banks. The focus lies on the bank specific features of the pass-through. For the moment, the interactions between the banking sector and the rest of the economy are not considered.

To enhance the comparability of the simulations across countries and rates, the monetary

[27] In the VECM specification the main change lies in the cointegration specification. For example, for the variables private demand, CPI, money market rate and government bonds, the Johansen tests indicates a cointegration rank of 3, i.e. three cointegrating relations. The first can be interpreted as a long-term demand for money that links the private demand and the money market rate. The second is the long-run equilibrium of the real interest rate or Fisher equation (difference between nominal rate and inflation). Finally, the connection between short-term and long-term rate is the term structure. Those long-term cointegrated relations are theoretically founded, but there is no guarantee for the accuracy of the estimates proposed by the tests.
Unlike in the case of the pass-through, the cointegration restrictions, such as they are formulated, have to be rejected. Indeed, large discrepancies in the dynamics derived from both the SVAR and the VECM are disclosed.

shock has been standardized to one percentage point rise above the baseline over one year[28] instead of the conventional one standard deviation innovation. In this way, the shock is exactly the same for all rates and all countries. The motivation is also to reproduce artificially the current situation where the ECB decides upon the money market rate variations for the whole Euro-zone. The confidence bounds are computed following the bootstrap method with 1000 iterations (Runkle (1987)) for a 90% confidence interval. The impulse responses are plotted over a period of five years (60 periods)[29]. The whole period 1980-2000 is first considered. Appendix II reports few examples (Belgium, Germany, Ireland and Spain) for several lending rates together with the confidence intervals. We first describe the large tendencies for all countries. Afterwards, each retail rate is considered separately to underline their characteristics. Subsequently, we attempt to explain those features, and finally, we consider the simulation on a sub-period.

Overall, Spain, Italy, Greece and to some extent the Netherlands experience the largest reaction although they almost never complete a full pass-through within a five year period (except for some STF). At the other extreme, Ireland, Belgium, Portugal, Austria and United-Kingdom present modest reactions (around 0.5% or lower, sometimes negative values). The mid-group gathers France, Germany and Finland[30]. The division of the countries appear to be different as far as the vanishing of the effects is concerned. For Germany, the Netherlands, France and Belgium, the impulse responses are not significantly different from zero starting from more or less one year and a half. On the contrary, in Italy, Spain, Greece, Austria and Finland, it almost takes three years and a half for the effects to vanish.

In particular, the reactions of the different retail rates and government bond rates (B) present typical features[31] (See Appendix III). The government bond rates react quite smoothly and the pass-through fluctuates around 0.5% point at his maximum impact. The dynamic is rather stable, yet there is a slight tendency to converge to zero. France, Germany, the Netherlands and the UK converge more rapidly than Austria, Italy and Spain. Belgium, Portugal and Ireland do not show any significant reaction.

The reaction of the long-term rate for households (LTH) demonstrate a quite similar pattern[32]. The transmission of the interest increase is quite limited and in the long run, the impulse responses return to zero (except for Finland and Spain where the effect is relatively persistent). Portugal displays a quite unexpected pattern. The impulse responses of the long-term rate for firms (LTF) reach higher values (around 0.5% point and above after 2 years) but there is still no full pass-through. This result is quite robust across countries except for Greece and Ireland.

The comparison of the short-term rate for firms (STF) leads to a more interesting analysis. This retail rate reacts the strongest to policy shocks and the heterogeneity between countries

[28] As a matter of fact, a series of shock (12) is produced such that the rate remains one percentage point above its baseline for one year. This simulation relies on the impulse response analysis technique even though this denomination is quite inapproriate in our case. Indeed, the original impulse response functions are usually computed for a unique impulse and not for a series of shocks.

[29] At this stage of the study, the simulations are carried out with Gauss.

[30] Interpretation of the results for Austria, Finland, Greece, Italy, and the UK requires some caution due to the size of the sample.

[31] For clarity of exposition, the confidence bounds are not reported.

[32] The series containing insufficient data are eliminated.

is more obvious. Nevertheless, there is one common feature to all countries, the STF follows narrowly the course of the money market rate. This is not really surprising since it is the shortest retail rate. The impulse responses rise until month 13 to 15 and then converge (except for Greece that steadily increases). Germany, the Netherlands, Spain, France and Italy (but at a slower pace) start to converge a few lags after the end of the shock in the money market. Ireland, Belgium and Portugal differ from the other countries by their small (sometimes negative) transmission of the shock.

It is not the purpose of this paper[33] to explain into detail the reasons of the extent and the speed of the adjustments described above. However, it is possible to link the outcomes to some potential explanations. The difference between the long-term and the short-term maturities could be partly due to the term structure of the interest rates and the expectations formation. However, it could also be interpreted as a buffer effect. The banks do not necessarily fully pass on the shock and so protect the investment of the firms and the households. This buffer behaviour is even more present for the households. On the contrary, the buffer is far less pronounced for the short maturity. This may also be related to the internal equilibrium of the banks that need short-term liquidity to face the rise in the money market. In this respect, a study of the deposit rates and the setting of the lending rates (banking spreads) may provide some explanations. Hence, it can not be excluded that the market structure of the banking sector influences this process.

Because the European banking sector has recently undergone serious reforms and changes in the regulation and the intensity of competition[34], it seems interesting to repeat this analysis for a sub-period, 1992-2000. While some convergence could be expected, it is not very clear in the estimations. Even worse, some strange and unexplained outcomes appear for the LTH and LTF. Conversely, the bonds and the STF demonstrate an apparent converging behaviour; the evolution is quite homogeneous in the long run. This may be a benefit of the lower volatility of the money market thanks to the harmonized monetary policy. However, some divergences are still observed between approximately 6th and 12th month, which is exactly the time of the maximum effect. Hence, there are still significant differences in the maximum level of the pass-through completion. This is confirmed by the tables of Appendix IV. The first one reports for 1980-2000 and 1992-2000 the level of the pass-through after 1, 3, 6, 12, 24 and 60 months. The second table reports the standard deviations at those points in time for each type of rate across country. Although this methodology is probably not the most appropriate one to test for the integration of the banking markets, the evidence tends to deny a further strong convergence in the European banking market.

As a matter of fact, the European countries still seem to show quite different behaviour in their impulse responses. Moreover, this statement tends to hold also for the different types of rates, lenders and maturities within the countries. In some cases the monetary policy shock is reflected rather quickly in the lending rates, in others not. The differences regard also the extent to which the 1% point variation is transmitted. These features may, somehow, establish some

[33] But it is our intention to pursue further research in this direction.

[34] See also Mojon (2000).

evidence of differences in the transmission of monetary policy through the bank intermediation in Europe. Eventually, this could create distortions in the costs of investment in Europe, and, in the end, this could prove to have differential effects on the real economy. This point will be investigated in the next section.

5 Simulations for a single EMU monetary policy

By including the pass-through in a larger system, we allow for interactions between the banking sector and the economy. So the pass-through, previously measured, may by influenced by macro fundamentals that are neglected in the bivariate case, and vice versa.

Similarly to the bivariate case, the simulated shock is also harmonized for the multivariate case. Indeed, a 1% point rise from the baseline of the money market rate over two years (8 quarters) is considered. Again, the purpose is to mimic a policy change by the ECB. The graphs of the simulated response functions cover 6 years.

This section is organized as follows. First, the different specifications are presented. We then draw broad conclusions that hold for all countries. Subsequently, some nuances are added by considering the differences across countries.

To identify the transmission channels and the possible differential effects arising from the introduction of the pass-through, several specifications are tested. First, a three variables benchmark case includes private demand, inflation and the money market rate. Then a distinction is made between investment and consumption (four variables system). Finally the inclusion of the short-term rate for firms[35] and of the government bond rate constitute two systems including five variables. By comparing these four systems, it is possible to broadly identify several features. As illustration, the four plots for Belgium and France are reported in Appendix V.

First, the breakdown of the private demand into its components, private consumption and investment, highlights the fact that essentially investment is affected by the money market rate increase. While the impact on consumption amounts around -0.8% at its maximum impact, the investment curve bottoms at almost -4% for Belgium (statistically significant at 10%). Second, the fall in the investment is further deepened when the STF is introduced. The extent of this deepening depends on the completion of the pass-through. This statement is crucial. The differences in the pass-through completion creates asymmetries in the price of credit, hence the different impact on investment. In other words, the fuller the pass-through the stronger the impact on the investment. If the pass-through were full, there would be no reason to include the STF, and the money market would be sufficient to approximate the price of credit[36]. French investment reaches values around -8% at the maximum impact (12 periods). This is almost the double compared to the four-variables case. The timing is closely related to the evolution of

[35] We currently concentrate on the STF as the previous section underlines their interesting behaviour. The long-term rate for firms and the long-term rate for households could be considered but the data availability is less satisfactory. This is a further research possibility.

[36] This boils down to consider the following specification : private consumption, investments, inflation and money market rate. So, the second specification considered in this paper holds for the case where the pass-through is fully completed.

the STF and the money market rate; investment reverses its curve and starts increasing again as both rates fall below zero. This is observed a few lags after the shock stops and vanishes smoothly. Therefore, there seems to be a strong relation between investment and the STF set by the banks in accordance with the money market rate evolution. The relation is not as strong between investment and bonds. The bonds would rather be correlated with consumption. There is a slight tendency for private consumption to smooth its curve when government bonds are introduced. The pass-through of the bonds fluctuates around 0.2% for Belgium and 0.4% for France (less than 50% of the MM rise is transmitted) but there still might be a wealth effect that can cushion the effect of the increasingly expensive investment.

The Appendix VI provides the graphs including the bonds and the STF for all other countries considered. The features described above can all be recovered, though with some differences in the extent, across countries. The link between consumption and bonds is specially strong for the Netherlands, Spain, Portugal and to some extent for France. They experience a bond pass-through that approaches 0.5% at most. The STF pass-through is almost complete for France and the Netherlands, and somewhat less for Spain, and Italy. All these countries therefore experience a fierce drop in investment. At the other extreme, Portugal and Germany[37] do not show an important pass-through and, therefore, no strong impact on investment. For those countries, there seems to be a significant buffer effect. To some extent, Belgium belongs to this category even though the STF rises up to approximately 0.85%. In the end, some differential effects at the European level can not be excluded although it is difficult to draw conclusions concerning the extent of those discrepancies.

To conclude, the simulations performed in this section tend to support the existence of an intermediation role for the banks in the transmission of a monetary policy change. The extent and timing of the pass-through for the STF are strongly correlated with the impact on investment. This outcome could indicate some kind of bank lending channel[38]. To some extent, this relation exists for the bonds, although the bonds seem to be more related with consumption which could indicate a wealth effect (according to the denomination of the credit view).

6 Conclusions

The research on the asymmetries in the transmission of monetary policy in Europe, and specifically on the role of bank intermediation in this process, distinguishes two main strands of literature. The first one extends the traditional "VAR" literature by introducing some quantity data from bank balance sheets. The second concentrates on price data and estimates the transmission of monetary shocks to bank lending rates. In this paper we try to reconcile both approaches to investigate wether the banks play an important intermediation role in the transmission of monetary policy. In order to combine both approaches, a SVAR appears to be the most appropriate method.

The simulations for the pass-through to the bond rate and to the lending rates (long-term

[37] Some caution is required for Germany as the results are not very robust.

[38] Although no volume data ara used, so, another denomination might be more appropriate.

household, long-term firms and short-term firms) consider a 1% point rise in the money market rate over one year for all countries so to mimic the current single monetary policy of the ECB. It highlights some differences within and between countries. By and large, the long-term maturities do not seem to experience large reactions (on average, approximately half of the pass-through is completed). Conversely, the short-term firm rates present a more completed pass-through that seems to follow closely the evolution of the money market rate. Germany, France, Spain and the Netherlands, and to some extent Italy, show a stronger pass-through than Belgium, Ireland and Portugal.

These features are recovered in the enlarged SVAR simulations that investigates the impact of the pass-through on the real economy. There is some evidence for a role of banks, especially through the investment. A significant correlation exists between the extent and timing of the fall in the investment and the dynamics of the short-term firm rates. Therefore, two groups can be distinguished: France, Spain, Italy and the Netherlands cope with a considerable fall in investment while some buffer effect might be observed for Belgium, Portugal and Germany.

Further research will investigate more deeply the other lending rates and the significance level of the differences observed. In addition, a complementary analysis of this work would be to pursue the research in the direction of the determinants of the pass-through, namely, term structure, expectations, bank and market structure, bank relationships, alternative financing sources, etc. Moreover, the research to establish a theoretical framework underlying the pass-through process and its impact of monetary policy transmission constitutes another link in the chain.

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Appendix I

Table 1: **Data availability and statistics for each type of rate**

	Availability	1980-2000		1980-1991		1992-2000	
		Mean	St Dev	Mean	St Dev	Mean	St Dev
Austria							
MM	80:1-98:12	6.43	2.44	7.20	2.33	5.11	2.22
LTH	95:4-00:5					6.27	0.83
STF	95:4-00:5					6.71	0.84
B	80:1-00:5	7.24	1.77	8.26	1.22	5.79	1.39
Belgium							
MM	80:1-99:1	7.37	2.79	8.51	2.39	5.46	2.34
LTH	80:1-00:5	9.47	2.90	11.18	2.24	7.05	1.78
STF	80:1-00:5	11.34	3.41	13.12	2.92	8.80	2.25
LTF	80:1-00:5	9.83	2.84	11.49	2.33	7.47	1.51
B	80:1-00:5	8.84	2.67	10.45	2.14	6.56	1.39
Finland							
MM	80:1-00:4	9.76	4.36	12.64	2.10	5.61	3.30
LTH	80:1-00:5	9.61	2.55	10.96	1.14	7.69	2.76
LTF	80:1-00:5	9.32	3.03	11.09	1.37	6.80	2.98
B	92:11-00:4*					7.65	2.15
France							
MM	80:1-00:5	8.62	3.72	10.82	2.59	5.48	2.69
STF	84:4-00:5	9.16	2.72	11.13	1.28	7.35	2.41
LTF	84:4-00:5	8.92	2.57	10.71	1.34	7.27	2.32
B	80:1-00:5	9.33	3.28	11.36	2.64	6.44	1.38
Germany							
MM	80:1-00:5	5.95	2.49	6.73	2.36	4.85	2.25
LTH	82:6-00:5	7.60	1.49	8.27	1.26	6.83	1.37
STF	80:1-00:5	9.16	2.04	9.27	2.28	8.98	1.62
LTF	96:11-00:5					6.18	0.46
B	80:1-00:5	6.95	1.64	7.74	1.41	5.82	1.24
Greece							
MM	85:6-00:2	15.39	3.42	17.35	1.02	13.82	3.84
STF	80:1-00:5	22.73	3.92	23.11	2.63	22.19	5.20
LTF	80:1-00:5	20.06	4.14	19.77	3.23	20.47	5.16
B	86:5-00:5*	11.83	4.86	16.72	2.06	7.73	1.61

Source: IMF/IFS and ECB, computation by the authors. *series are discontinuous.

Table 2: **Data availability and statistics for each type of rate, Part2**

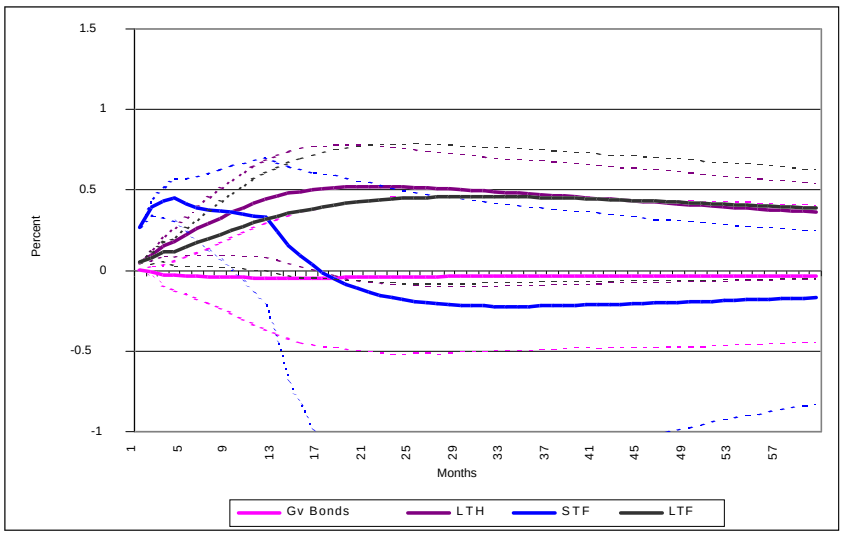
	Availability	1980-2000		1980-1991		1992-2000	
		Mean	St Dev	Mean	St Dev	Mean	St Dev
Ireland							
MM	80:1-00:5	10.31	5.30	12.63	3.37	7.00	5.76
LTH	80:1-00:5	10.19	3.05	11.98	2.12	7.64	2.28
STF	80:1-00:5	12.78	2.75	14.31	2.13	10.61	1.95
LTF	80:1-00:5	10.14	2.28	13.00	0.56	9.47	2.00
B	80:1-98:12	10.69	3.56	12.57	3.05	7.47	1.39
Italy							
MM	80:1-00:5	12.23	4.79	15.11	3.27	8.13	3.43
LTH	95:1-00:5					9.76	3.14
STF	89:2-00:5	8.84	3.14	11.66	0.45	7.87	3.08
LTF	95:1-00:5					7.97	2.75
B	80:1-00:5	11.98	4.45	14.08	3.95	8.98	3.25
The Netherlands							
MM	80:1-98:12	6.38	2.43	7.19	2.14	4.99	2.28
LTH	80:1-00:5	8.28	1.95	9.24	1.76	6.92	1.28
STF	80:1-00:5	6.71	2.65	7.83	2.29	5.12	2.30
B	80:1-00:5	7.52	1.76	8.35	1.67	6.35	1.12
Portugal							
MM	83:1-00:3	12.34	5.65	15.72	3.97	8.64	4.84
LTH	90:1-00:5	13.11	5.34	20.04	0.46	11.46	4.59
STF	90:1-00:5	13.90	5.83	21.74	0.49	12.04	4.88
B	80:1-00:3	13.90	5.23	17.38	2.42	8.78	3.88
Spain							
MM	80:1-00:5	11.62	4.71	14.45	3.05	7.58	3.57
LTH	80:1-00:5	12.84	3.68	15.13	1.04	9.56	3.63
STF	80:1-00:5	12.92	4.83	15.95	2.84	8.61	3.65
LTF	80:1-00:5	13.79	3.87	16.31	1.01	10.20	3.61
B	80:1-00:5	11.73	3.91	14.27	2.02	8.10	2.97
United Kingdom							
MM	80:1-00:5	9.30	3.20	11.47	2.18	6.20	1.30
LTH	95:1-00:5					7.65	0.93
B	80:1-00:5	9.45	2.56	11.03	1.83	7.20	1.57

Source: IMF/IFS and ECB, computation by the authors.

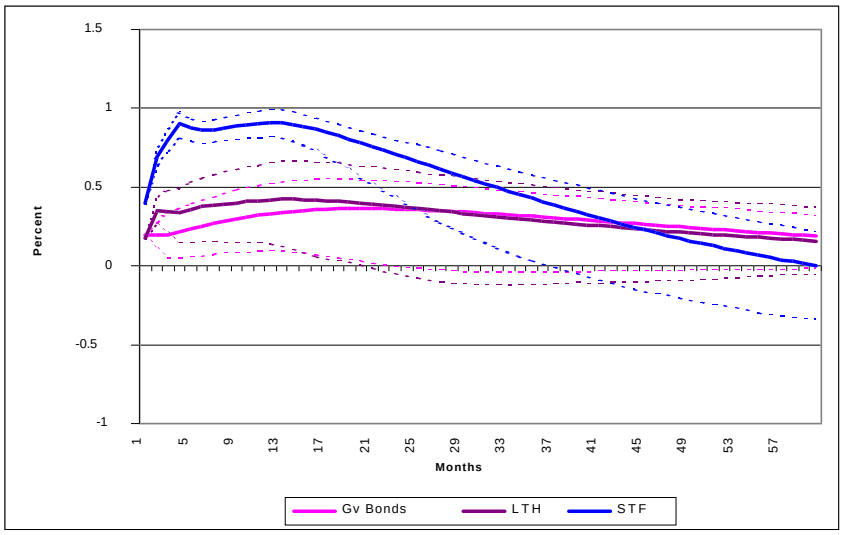
Appendix II : Pass-through in bivariate system

Impulse response functions for each type of rate for a 1% point rise in the money market rate over 12 months. Panel A : Belgium, Panel B : Germany, Panel C : Ireland, Panel D : Spain. Dotted lines represent the 90% confidence intervals.

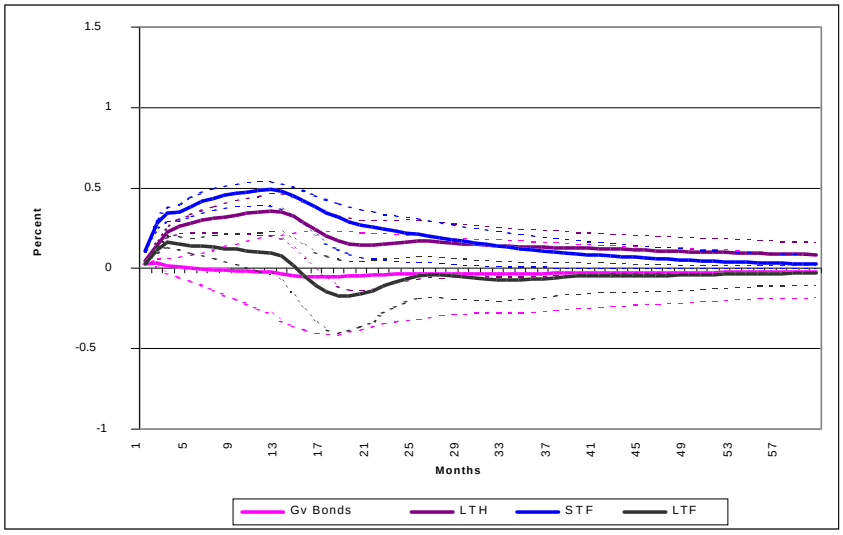
Panel A : Belgium



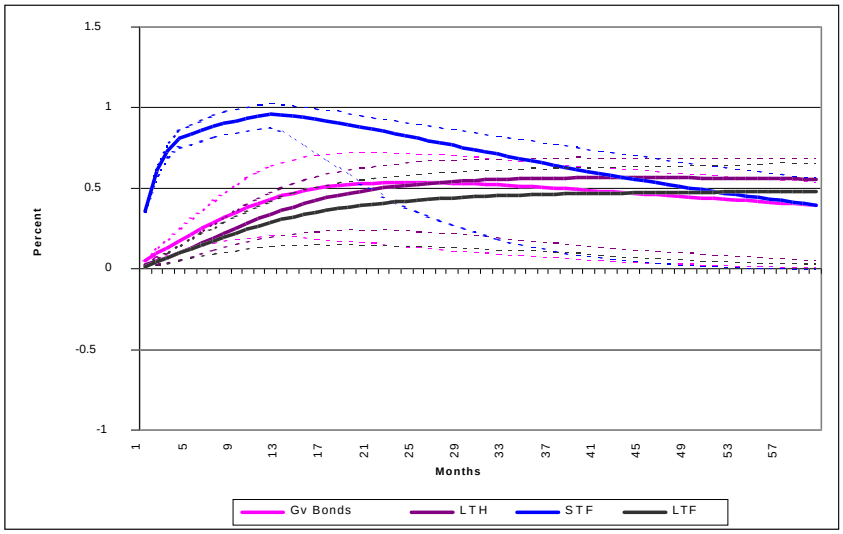
Panel B : Germany



Panel C : Ireland



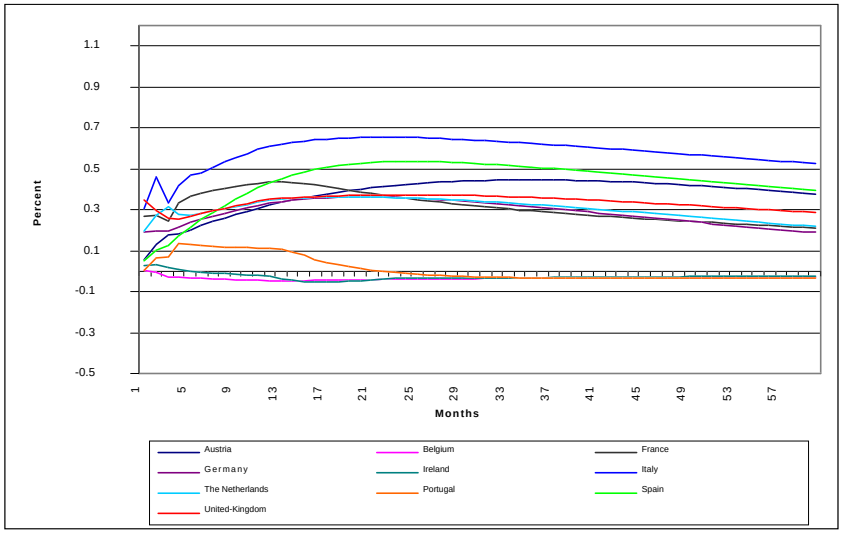
Panel D : Spain



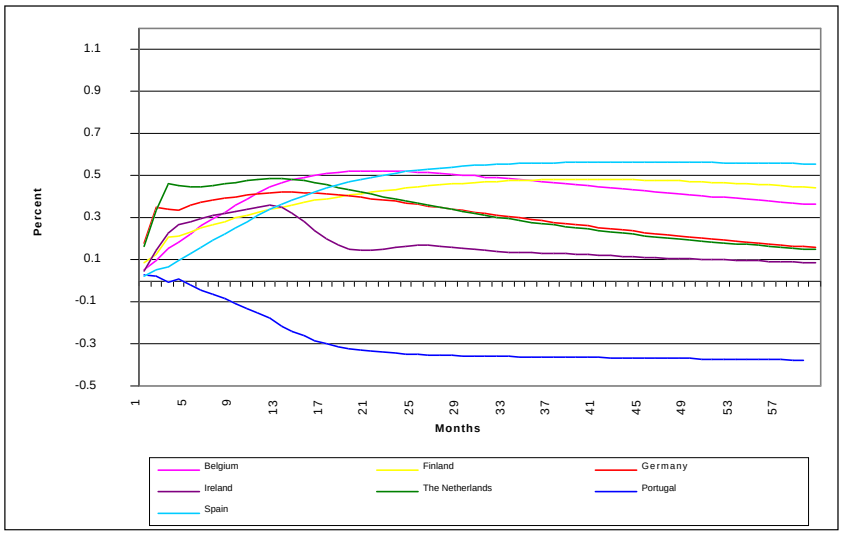
Appendix III : Pass-through for each type of rate across countries, 1980-2000

Pass-through for all countries classifed by type of rate. The shock is a 1% point rise in the money market rate over 12 months. Panel, A, B, C; D report respectivelly the government bond rate, the long-term households, the short-term firms and the long-term firms.

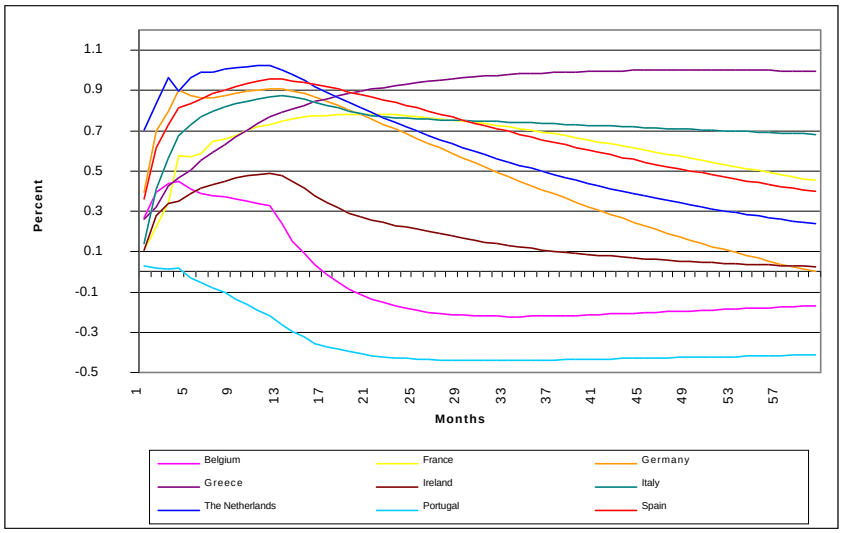
Panel A : Government bonds



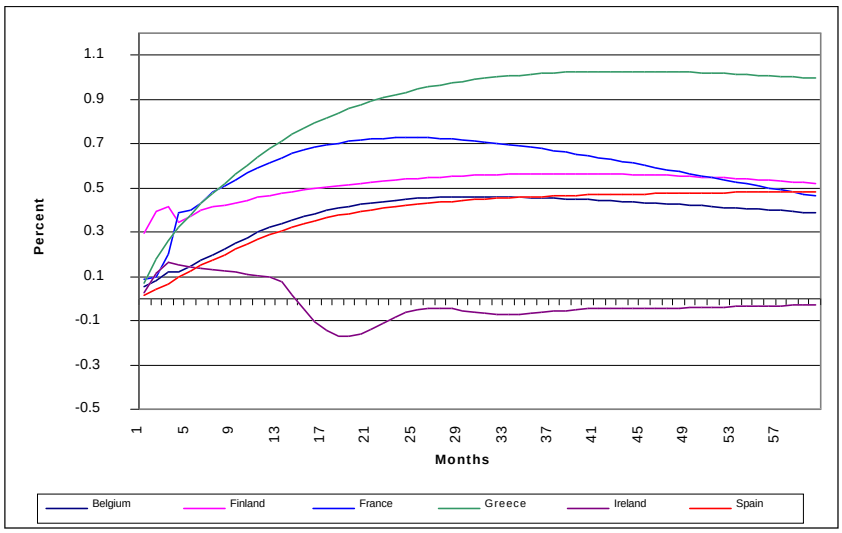
Panel B : Long-term households



Panel C : Short-term firms



Panel D : Long-term firms



Appendix IV : Magnitude and Standard deviation of the pass-through after 1, 3, 6, 12, 24, and 60 months

The first table provides the magnitudes of the pass-through completed after 1, 3, 6, 12, 24, 60 months for two periods : 1980-2000 and 1992-2000. Each country and type of rate is reported separately. The second table provides the standard deviations across countries for each type of rate for the same two sub-periods. The standard deviations are computed for 1, 3, 6, 12, 24, 60 months and for an average through time. Figures in italic cover less data points.

Table 3: **Magnitudes of the pass-through, 1980-2000 and 1992-2000**

	1980-2000						1992-2000					
Gov. Bonds	**1**	**3**	**6**	**12**	**24**	**60**	**1**	**3**	**6**	**12**	**24**	**60**
Austria	0.06	0.18	0.23	0.32	0.42	0.38	0.11	0.00	-0.26	-0.26	-0.01	0.13
Belgium	0.01	-0.03	-0.04	-0.05	-0.04	-0.03	0.05	0.04	-0.12	-0.07	0.14	0.18
France	0.27	0.25	0.38	0.44	0.36	0.21	0.12	-0.01	0.03	0.11	0.16	0.04
Germany	0.19	0.20	0.25	0.33	0.36	0.19	0.25	0.23	-0.02	0.03	0.22	0.07
Ireland	0.03	0.02	0.00	-0.02	-0.03	-0.02	0.03	0.03	0.02	-0.02	-0.09	-0.02
Italy	0.31	0.34	0.48	0.61	0.65	0.53	0.35	0.37	0.55	0.68	0.43	0.10
The Netherlands	0.20	0.31	0.28	0.35	0.36	0.22	0.23	0.17	-0.02	-0.04	0.00	0.05
Portugal	0.00	0.07	0.13	0.11	-0.01	-0.03	-0.07	0.20	0.25	0.31	0.21	0.10
Spain	0.05	0.13	0.25	0.43	0.54	0.40	0.16	0.27	0.20	0.26	0.35	0.16
United-kingdom	0.35	0.26	0.28	0.35	0.37	0.29	0.13	0.18	0.01	-0.04	-0.06	-0.01
LTH	**1**	**3**	**6**	**12**	**24**	**60**	**1**	**3**	**6**	**12**	**24**	**60**
Austria							0.05	0.26	0.31	0.32	0.08	0.01
Belgium	0.05	0.16	0.26	0.45	0.52	0.36	0.19	0.19	0.37	0.48	0.38	0.13
Finland	0.09	0.21	0.25	0.34	0.44	0.44	0.18	0.39	0.50	0.61	0.42	0.05
Germany	0.18	0.34	0.38	0.42	0.37	0.16	0.09	0.20	0.30	0.44	0.36	0.10
Ireland	0.05	0.23	0.30	0.36	0.16	0.09	0.02	0.16	0.10	-0.06	-0.22	-0.06
Italy							*0.31*	*0.63*	*0.83*	*1.03*	*0.91*	*0.12*
The Netherlands	0.16	0.46	0.45	0.49	0.38	0.15	0.14	0.34	0.22	0.27	0.30	0.12
Portugal	*0.03*	*-0.01*	*-0.05*	*-0.18*	*-0.35*	*-0.38*	0.04	0.07	0.18	0.35	0.40	0.27
Spain	0.02	0.07	0.16	0.34	0.52	0.56	0.05	0.40	0.39	0.14	-1.35	-0.57
United-Kingdom							*-0.20*	*0.26*	*-0.06*	*-0.47*	*-0.74*	*-0.02*
STF	**1**	**3**	**6**	**12**	**24**	**60**	**1**	**3**	**6**	**12**	**24**	**60**
Austria							*0.08*	*0.15*	*0.20*	*0.18*	*-0.02*	*-0.01*
Belgium	0.27	0.44	0.39	0.33	-0.18	-0.17	0.83	0.85	0.85	0.92	0.68	0.27
France	0.11	0.35	0.59	0.73	0.78	0.45	0.17	0.43	0.65	0.75	0.60	0.12
Germany	0.40	0.80	0.86	0.91	0.69	0.00	0.22	0.55	0.66	0.72	0.53	0.10
Greece	0.26	0.43	0.56	0.77	0.93	1.00	0.25	0.36	0.39	0.42	0.11	0.12
Ireland	0.11	0.34	0.42	0.49	0.22	0.03	0.03	0.20	0.19	0.18	0.04	0.00
Italy	*0.14*	*0.57*	*0.77*	*0.87*	*0.76*	*0.68*	0.15	0.60	0.77	0.86	0.68	0.45
The Netherlands	0.71	0.97	0.99	1.03	0.72	0.24	0.37	0.53	0.79	0.87	0.54	0.11
Portugal	*0.03*	*0.01*	*-0.05*	*-0.22*	*-0.43*	*-0.41*	0.08	0.11	0.13	0.14	0.02	0.01
Spain	0.36	0.73	0.86	0.96	0.83	0.40	0.78	1.02	1.00	1.00	0.74	0.22
LTF	**1**	**3**	**6**	**12**	**24**	**60**	**1**	**3**	**6**	**12**	**24**	**60**
Belgium	0.05	0.12	0.17	0.32	0.45	0.39	0.39	0.21	0.04	0.10	0.32	0.20
Finland	0.30	0.42	0.40	0.47	0.54	0.52	0.42	0.87	0.81	0.93	0.72	0.25
France	0.09	0.20	0.43	0.62	0.73	0.46	0.08	0.23	0.39	0.50	0.41	0.13
Greece	0.07	0.26	0.43	0.68	0.93	1.00	0.08	0.25	0.40	0.64	0.60	0.53
Ireland	*0.03*	*0.16*	*0.14*	*0.10*	*-0.06*	*-0.03*	0.03	0.17	0.17	0.16	0.03	0.00
Italy							*0.56*	*0.78*	*0.92*	*0.99*	*0.73*	*0.20*
Spain	0.02	0.07	0.15	0.29	0.42	0.48	0.29	0.69	0.47	0.40	-0.73	-0.33

Source: IMF/IFS and ECB, computation by the authors.

Table 4: **Standard deviation of the pass-through across countries, 1980-2000 and 1992-2000**

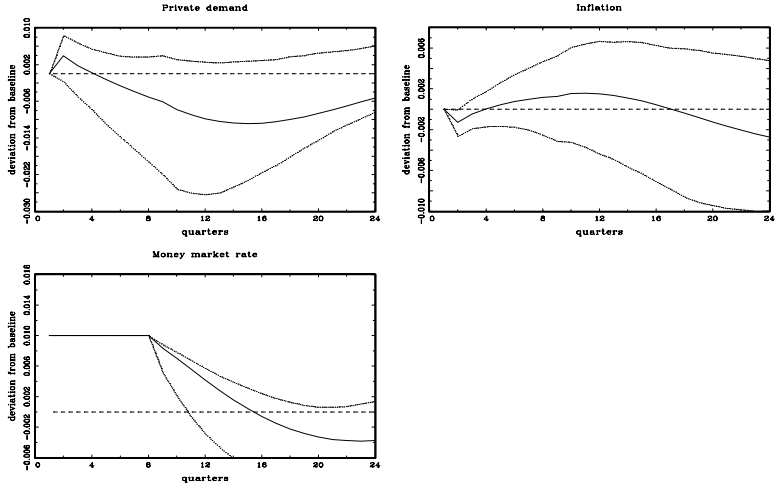
	B	LTH	STF	LTF
1980-2000				
1	0.13	0.06	0.21	0.10
3	0.12	0.16	0.29	0.12
6	0.16	0.16	0.32	0.15
12	0.21	0.23	0.40	0.22
24	0.24	0.31	0.49	0.34
60	0.19	0.31	0.44	0.33
Average	0.18	0.20	0.36	0.21
1992-2000				
1	0.12	0.13	0.29	0.21
3	0.13	0.16	0.30	0.31
6	0.22	0.24	0.31	0.32
12	0.26	0.40	0.34	0.35
24	0.17	0.66	0.31	0.52
60	0.07	0.23	0.14	0.26
Average	0.16	0.30	0.28	0.33

Source: IMF/IFS and ECB, computation by the authors.

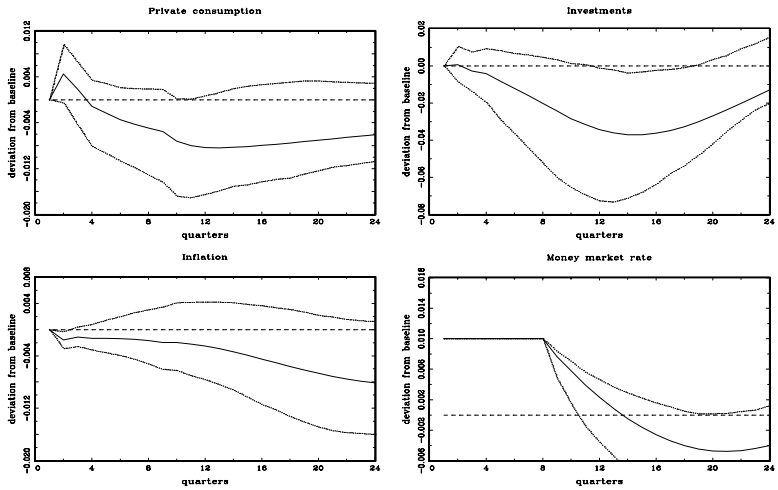
Appendix V : Simulations for a single EMU policy; four specifications for Belgium and France

Simulations of a 1% point rise in the money market rate over 8 quarters where the value of 0.01 corresponds to 1%. Panel A presents the 3 variables case : private demand, inflation, money market rate. Panel B presents the 4 variables case : private consumption, investments, inflation and money market rate. Panel C and D present the 5 variables cases including : private consumption, investments, inflation, money market, and respectivelly government bonds and short-term firms.

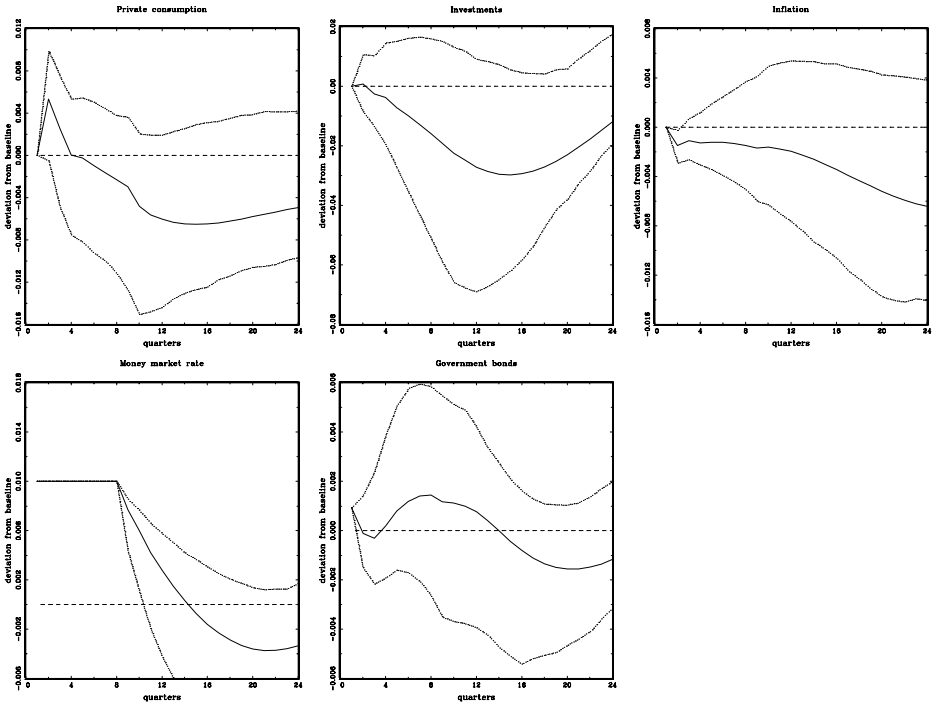
Belgium



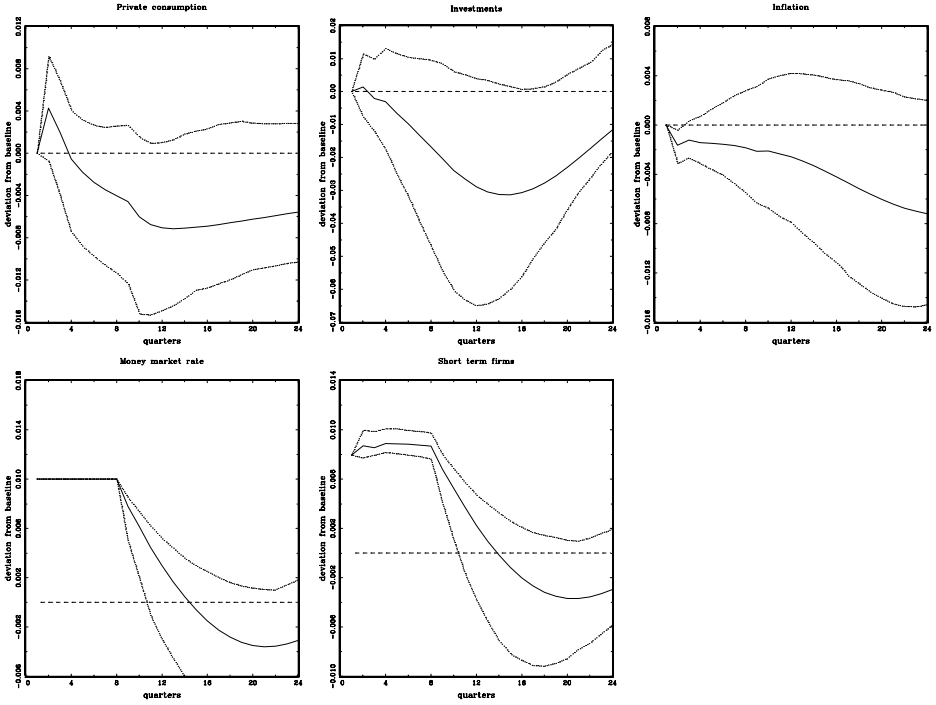
Panel A



Panel B

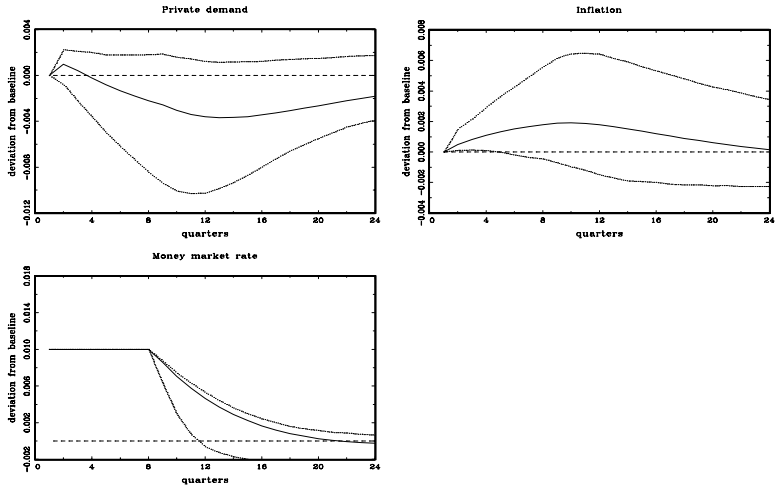


Panel C

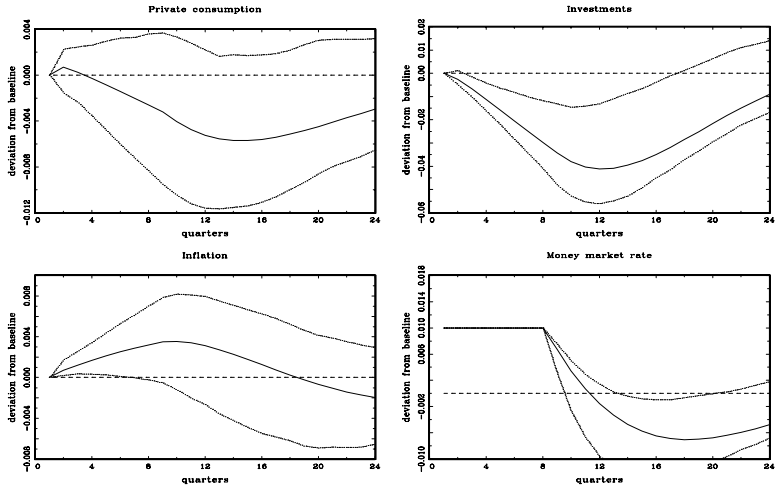


Panel D

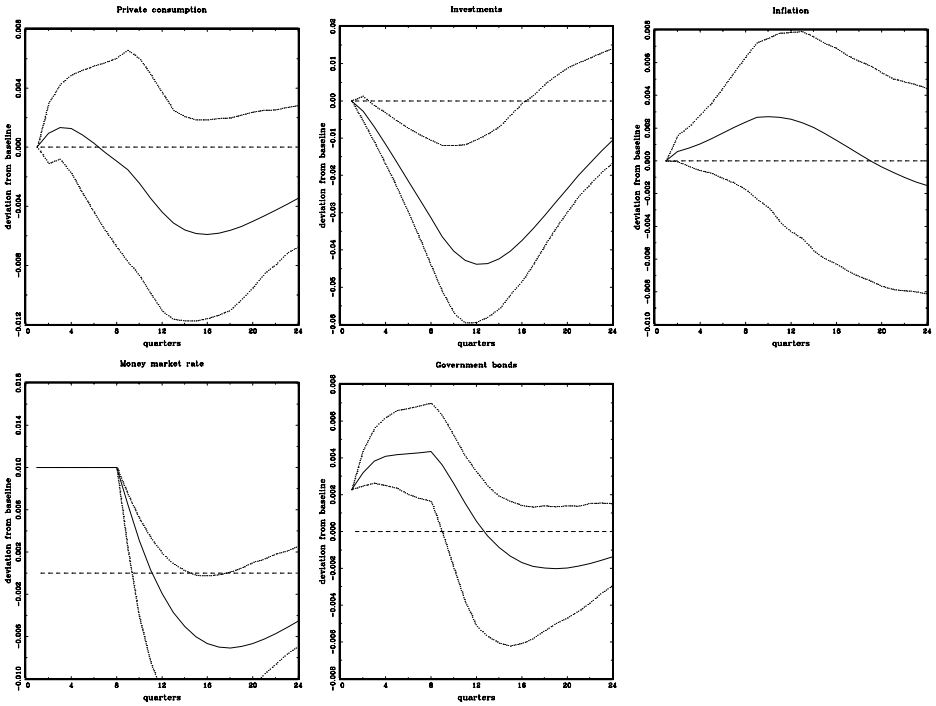
France



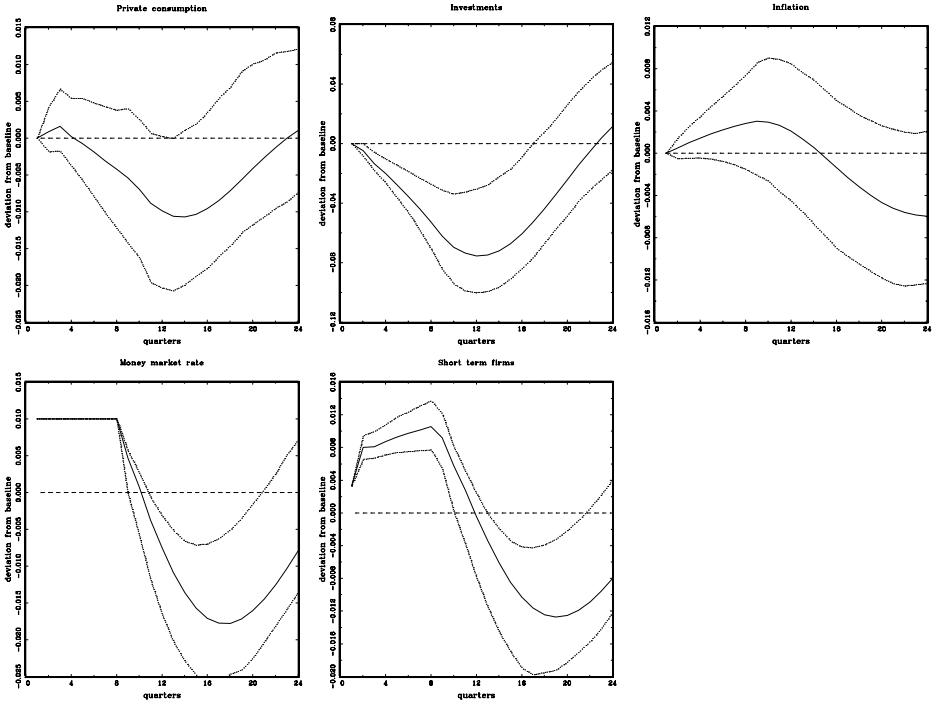
Panel A



Panel B



Panel C

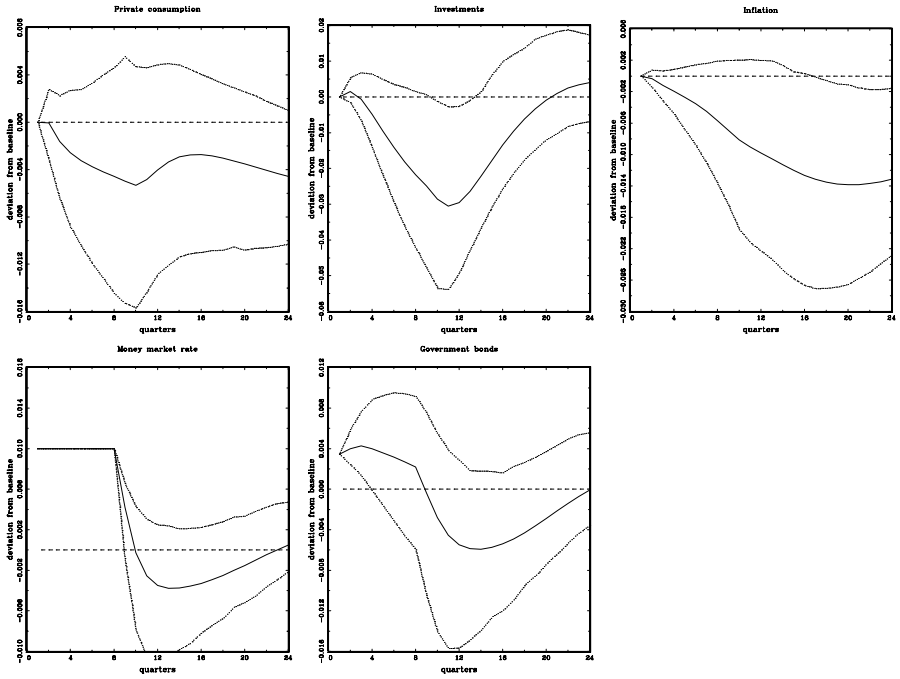


Panel D

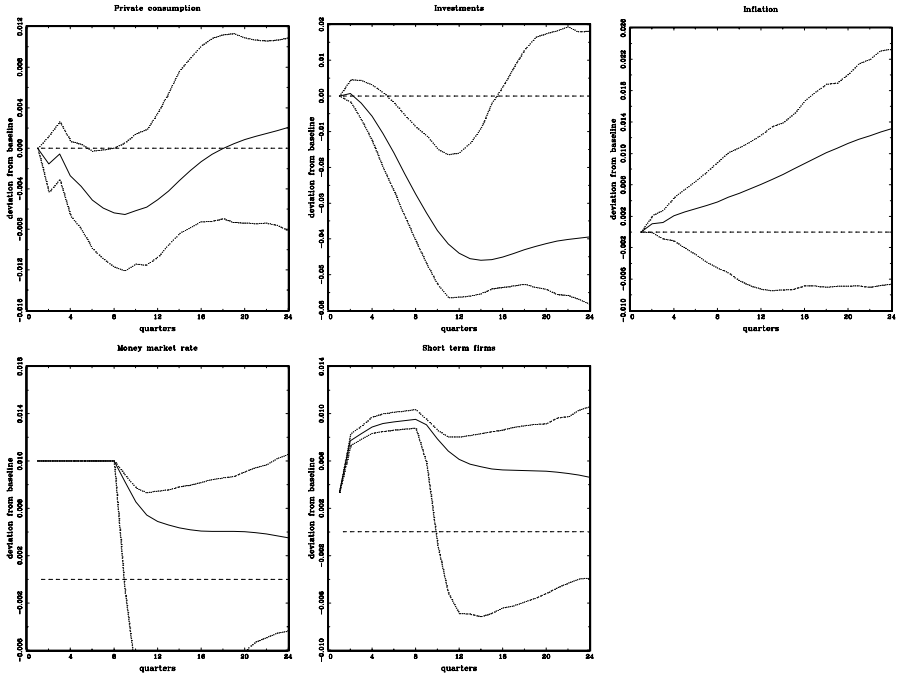
Appendix VI : Simulations for the remaining countries, two specifications

Simulations of a 1% point rise in the money market rate over 8 quarters where the value of 0.01 corresponds to 1%. Panel A and B present the 5 variables cases including : private consumption, investments, inflation, money market, and respectivelly government bonds and short-term firms. The remaining countries are : Italy, Spain, the Netherlands, Germany and Portugal.

Italy

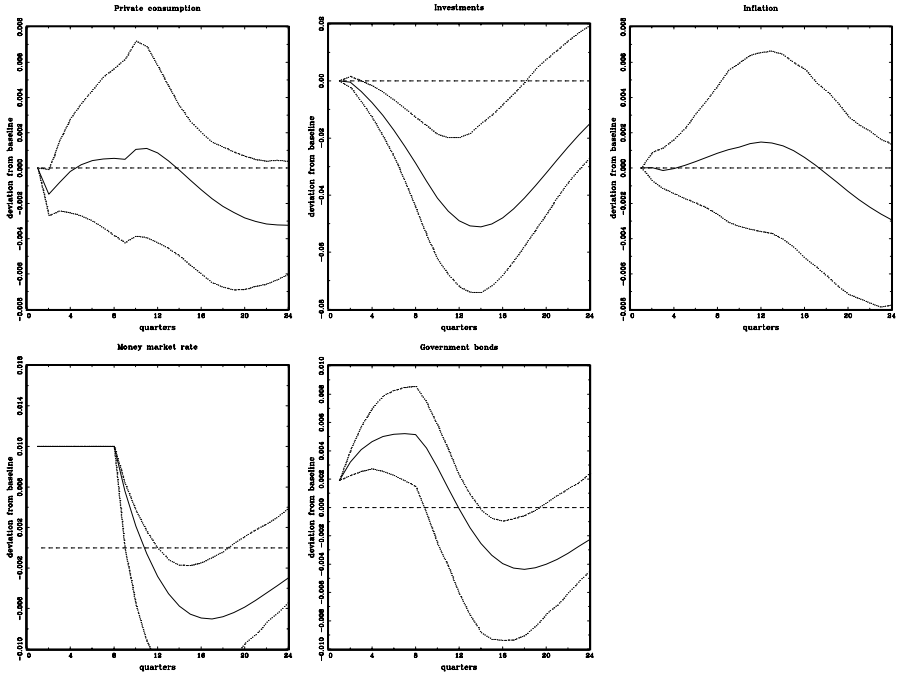


Panel A

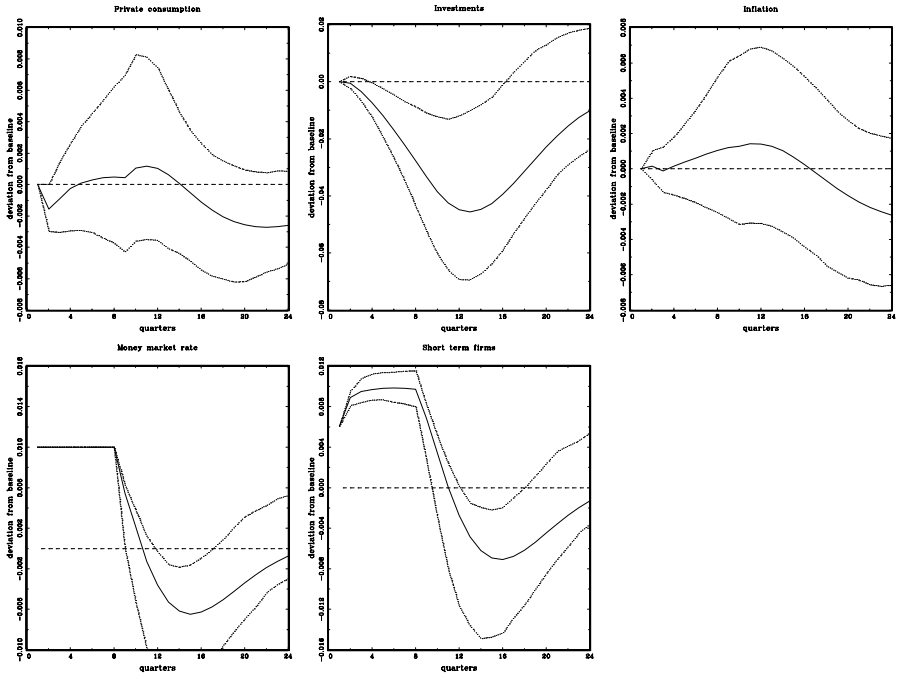


Panel B

Spain

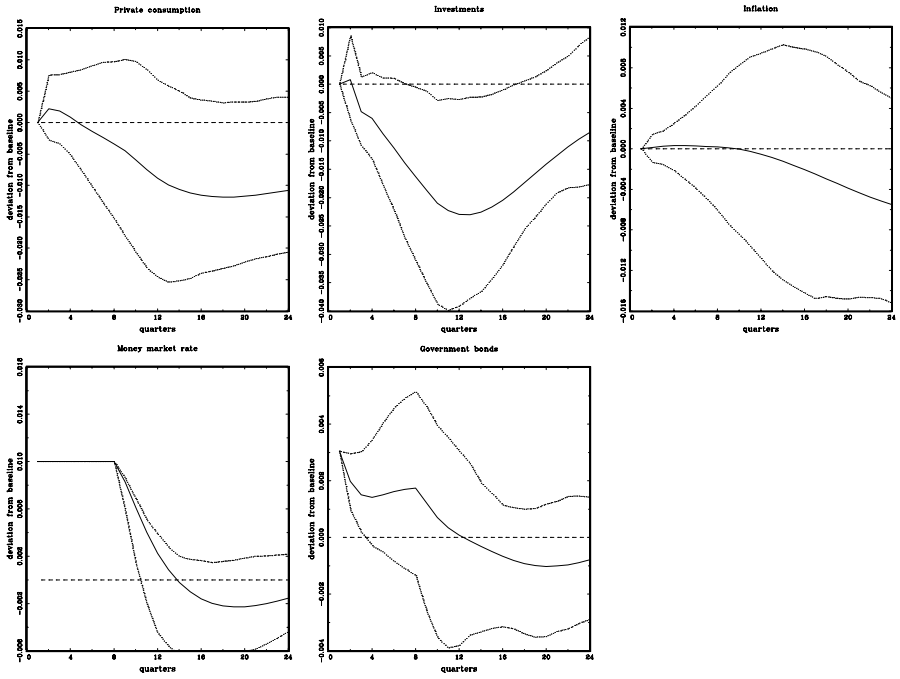


Panel A

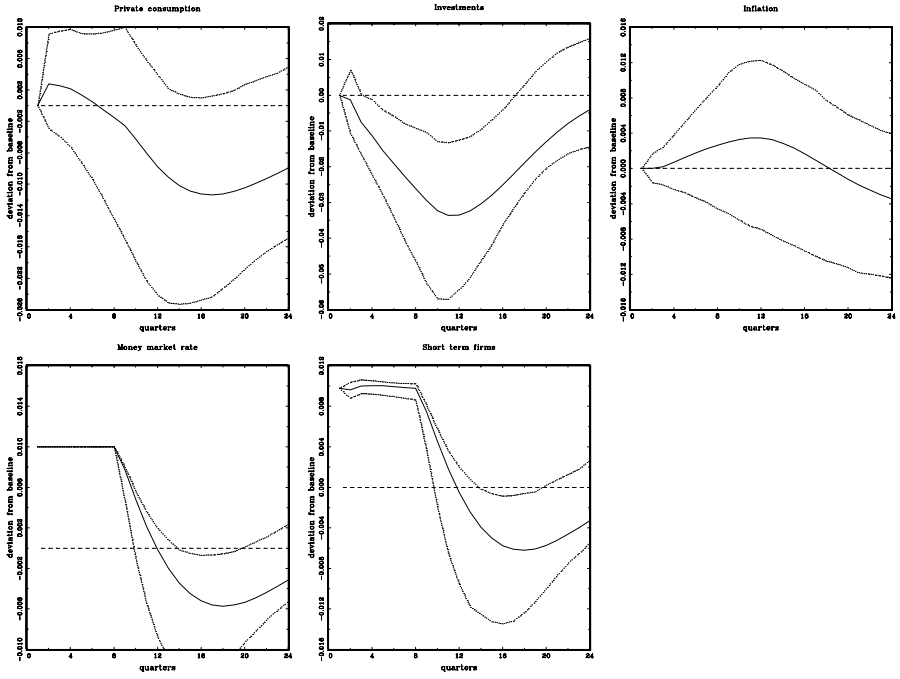


Panel B

The Netherlands

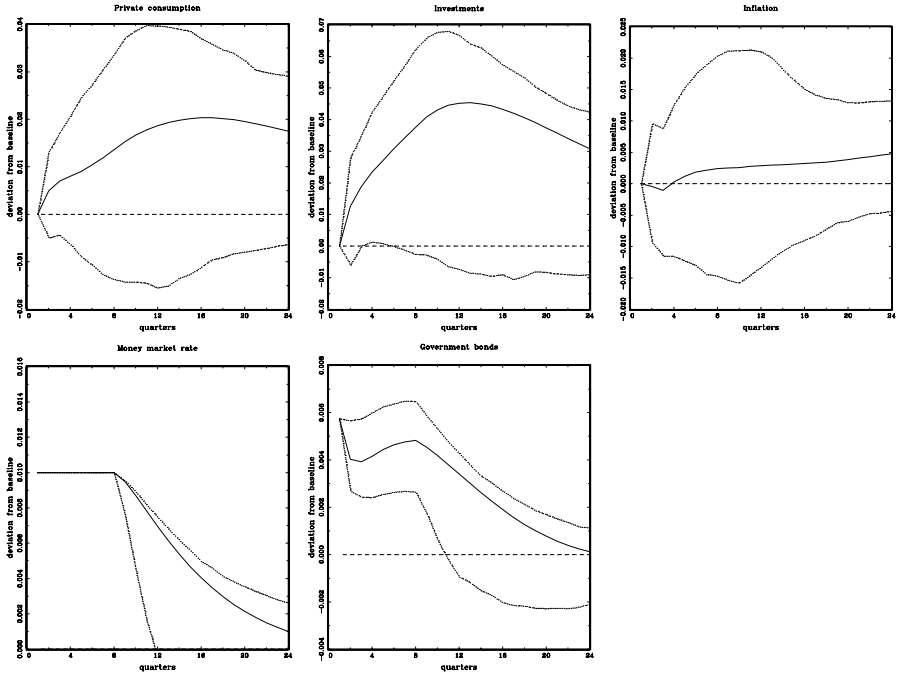


Panel A

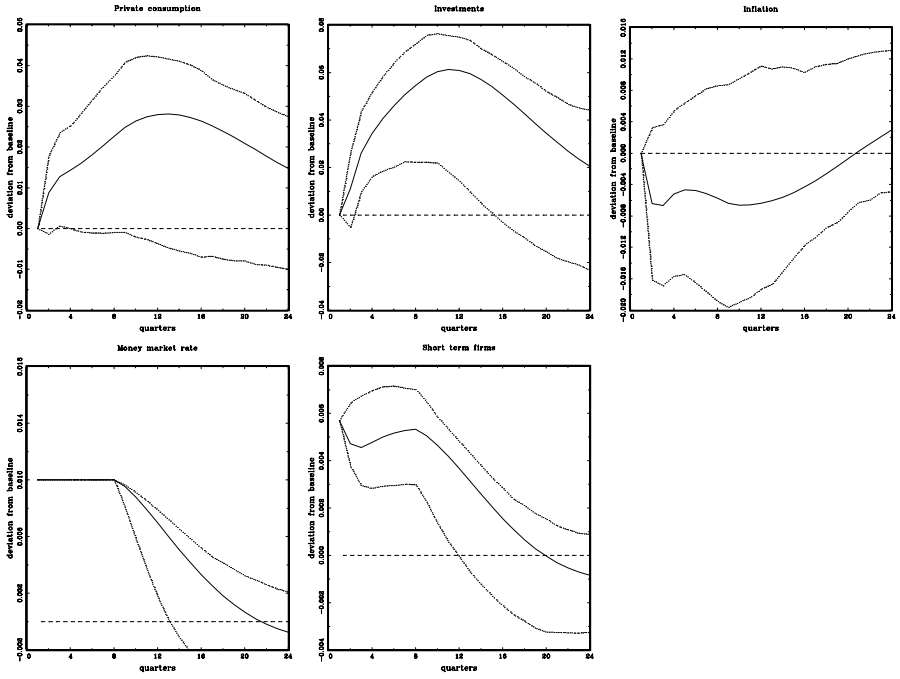


Panel B

Germany

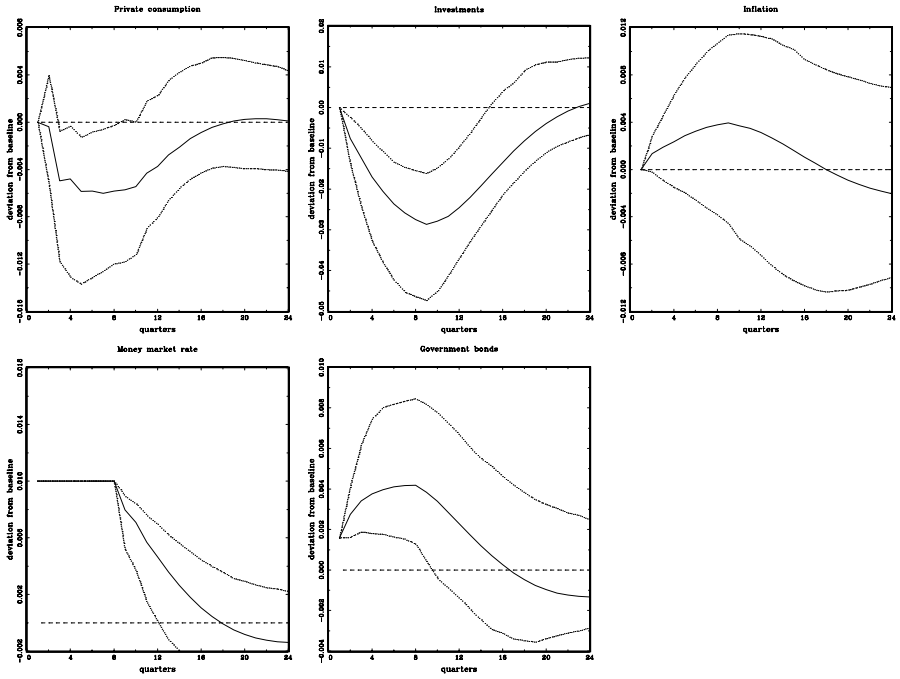


Panel A

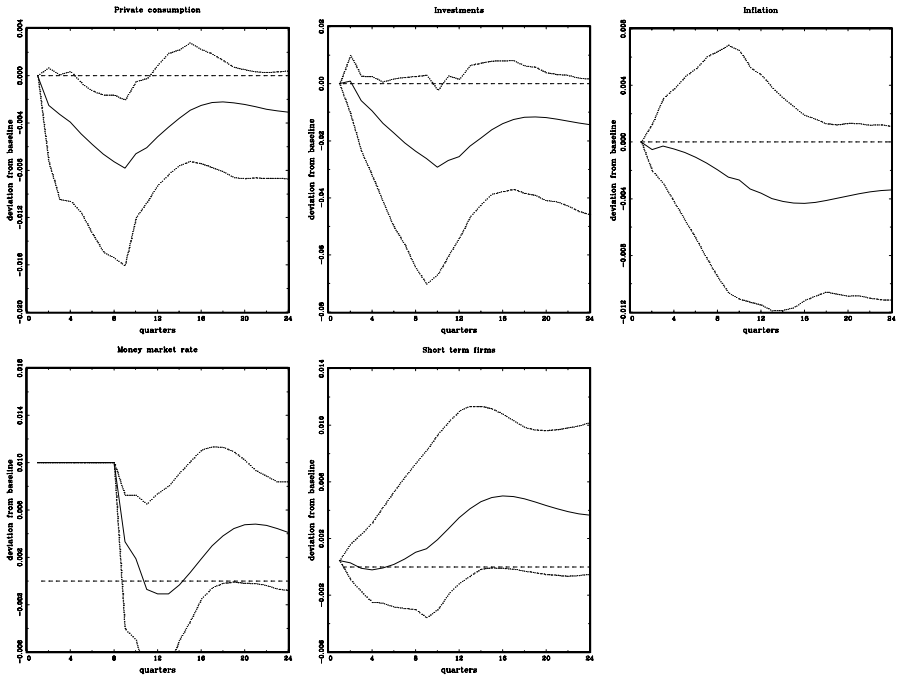


Panel B

Portugal



Panel A



Panel B